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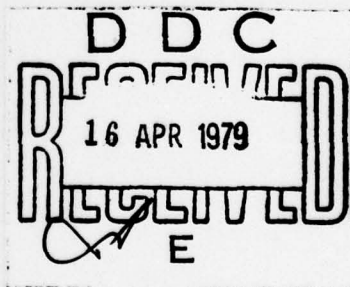
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By

Chu Min-kwang



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The Shaking in Flight

By
Chu Min-kwang

As we know, the lift force of an aircraft is mainly produced by the aerodynamic force working against the wing. Anyone who has the experience of being on board an airplane knows that it is very uncomfortable when the plane shakes up and down during taking-off or landing. The situation will become worse if the plane confronts a turbulent current and someone may become sickening or vomiting. In fact, flight in turbulent current, in addition to making passengers uncomfortable, means to put the structural strength of a plane under threat and test. In the following, we shall discuss the impact of turbulent current on the structural strength of a plane. Should a plane increase its speed to hurry through the turbulent current or should it decrease its speed to pass through the current?

The lift force on the wing of a plane not only supports the weight of the wing itself but also support the total weight of passengers, cargo and the plane. On the other hand, the degree of shaking when a plane is flying in turbulent current is not determined by the weight of the wing, but by the total weight of the passengers, cargo and the plane itself.

For an easier explanation, we take the following as an example. When we tie an object to one end of a rope and then we pull up the rope slowly, the rope can stand the weight of the object and will not break. If we pull the rope up suddenly and pull it up with sharp jerks repeatedly, the rope will break. This is because the sudden action produces acceleration.

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According to Newton's second law, the rope and the object tied to one of its ends will produce acceleration force and this force is much larger than the gravity the object has when it stands still, so the rope breaks. In this example, the rope stands for the wing of a plane and the object tied to it is the weight of the plane and its passengers and cargo. From this example, we know that the weight of the rope or the wing of a plane does not determine whether the rope or the wing will break or not when the outside acceleration force is working against it. But it is the object tied to the rope or the weight of the plane and its passengers, and cargo that determines whether the rope or the wing will break or not.

Based on such a theory, we can understand the reason that the engine and especially the fuel tank of large planes are all set in the wing, particularly in the outer wing. Furthermore, during the flight, to use fuel is usually following such an order: to use that which is in the tanks in the inner wing first, then those in the outer wing.

In order to guarantee not having accident caused by the additional burden produced by turbulent current in the flight, in designing a plane, the structural strength of a plane must have a design load factor based on the accumulated experience from different regions, seasons and altitudes. A design load factor simply means that the ratio between the weight of a plane and the total aerodynamic force working against its wings. In other words, the force received by a plane when it flies steadily is multiplied by this factor, and the product will be the equivalent static effect produced from the time when the plane receives an acceleration force. For instance, a

plane of a total weight of 100 tons, its wings must be designed to be able to support a total weight which is the product of 100 tons multiplied by this load factor. It is this kind of wing which can stand the roughness when the plane is flying in turbulent current. In practical flight, the danger of strong wind must be given consideration so that it can prevent the wing from breaking by the strong wind when the plane is flying in turbulent current. It is also necessary to regulate a speed for the pilot. Generally speaking, when a plane enters a strong turbulent current, the pilot must properly reduce the power (thrust) of the engine and reduce the speed of flight.

- (a) A Model Working Diagram of an Escort Fighter in Actual Proportion
-- Two piston-type fighters of later structural model --
- (b) Aircrafts in history
- (c) Cabin air-adjusting intake opening
- (d) Gear operation bar
- (e) Deep hole (connected with the hole at wing tip)
- (f) Radio antenna
- (g) 14 cylinder V engine
- (h) Cabin cover opening position
- (i) Air-speed tube
- (j) Taxing, contact light
- (k) (Yellow) (black)
- (l) Air-speed tube (silver-colored top)
- (m) Navigation light
- (n) Contact light stored in the landing gear cabin
- (o) Unguided rocket x 6 , (127 mm)
- (p) 127mm cannon x 6
- (q) Front bullet-proof steel board, 454KG, bomb x 2 (hanging outside)
- (r) Wing setting angle
- (s) Control bar
- (u) Fueling opening of fuel tank in the wing
- (v) Fuel control handle
- (w) Cabin step board (it can be pulled up when the plane tries to stop)
- (x) Air-intake opening of heat-diffusor
- (y) Aiming instrument (black), instrument board (black)
- (z) Pedal

- (a') Formation light
- (b') Formation light
- (c') Signal gun (red, yellow, green and white)
- (d') Diagram of arrangement in the cabin
- (e') Antifreezer sprayer
- (f') Shutters of the general exhaust of side engine; Navigation light
(left red, right green)
- (g') 427L auxiliary fuel tank x 2 (hanging outside)
- (f'') Lid of fuel tank in the body
- (h') Light grey color
- (i') Dark green
- (j') Silver grey
- (k') Tail light (white)
- (l') Tail light
- (m') Light grey
- (n') Wing setting angle
- (o') Explanation

1. In this drawing, there are two kinds of piston-type engine fighters which were available in the 1940's. The selection of engine and the aerodynamical outside structure are all perfect. The maximum speed is 680-710 km per hour. The speed cannot be increased until the advent of jet plane.
2. If there is no underneath-wing rocket, there is no need of a rocket hanger.
3. The colour of the model, except for those indicated in this drawing, can be treated as usual.
4. The planes are LA-11, P-51-D5.

- (p') Deep hole
- (q') Inside heat-diffuser
- (r') Engine cover; Seal ring (stainless steel colour); Fuel opening of fuel tank in the wing

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(s') 14 cylinder star-type engine

(t') 20mm cannon x 3; (red)

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